

Intro to Logic
Spring 2007 Final Exam

Section I. Predicate Logic Translations. Translate each of the following sentences into predicate logic notation, using the designated predicate letters. (6 points each)

- 1) Zachary is both a logic instructor and a ham radio operator. (Lx, Hx, z)
- 2) There is nothing new under the sun. (Nx, Ux)
- 3) Not all students will pass this course. (Sx, Px)
- 4) Students will pass the course if and only if they pass the final exam. (Sx, Cx, Fx)
- 5) No person loves anyone who loves himself. (Px, Lxy)
- 6) If there are any sea lions who are swimming, then there will be some sharks who are hunting. (Lx, Sx, Rx, Hx)
- 7) All people who study logic recognize all sound arguments. (Px, Lx, Rxy, Sx, Ax)
- 8) Superman is Clark Kent.
- 9) The only people who are Logic TA's are Ben and Michael. (Px, Lx, b, m)
- 10) All Vice Presidential Candidates except Geraldine Ferraro were men. (Vx, Mx, g)
- 11) The greatest philosopher living in the twentieth century was Wittgenstein. (Px, Lx, Gxy, w)
- 12) There are at most two senators from California. (Sx, Cx)
- 13) There are at least two governments that are communist. (Gx, Cx)
- 14) There are exactly two quantifiers in predicate logic. (Qx, Px)

15) The inventor of the telephone was Alexander Graham Bell. (Ixy, t, a)

Section II. Predicate Logic Proofs. Complete a proof for each of the following arguments to show its validity. (20 points each)

- 1) 1. $\exists x \exists y (Qx \bullet Ryx)$
 2. $\forall x \forall y [Rxy \rightarrow (Sx \bullet Tyx)]$ / $\exists y \exists z [(Qy \bullet Sz) \bullet Tyz]$
- 2) 1. $\forall x \forall y [(Nx \bullet Ox) \rightarrow Pxy]$
 2. $\exists y [Ry \bullet \forall z (Sz \rightarrow Pyz)]$
 3. $\forall x \forall y \forall z [(Pxy \bullet Pyz) \rightarrow Pxz]$
 4. $\forall x (Rx \rightarrow Ox)$ / $\forall z \forall y [(Nz \bullet Sy) \rightarrow Pzy]$
- 3) 1. $\exists x \forall y (x=y \equiv Wy)$ / $\exists x (Wx \bullet Vxx) \equiv \exists x \exists y (Wx \bullet Wy \bullet Vxy)$

Section III. Translation and Proof. Translate the following argument into logical notation. Then show that the argument is valid using a proof. (30 points)

Some people are enemies of every person they loathe. Every person loathes someone other than himself. Therefore at least one person is an enemy of someone. (Px, Exy, Lxy)